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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/588,423	09/28/2007	Simon Barendregt	P/4944-2	8339

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EXAMINER

BHAT, NINA NMN

ART UNIT	PAPER NUMBER
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1797

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06/17/2010

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/588,423	Applicant(s) BARENDREGT ET AL.	
	Examiner N. Bhat	Art Unit 1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 April 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 August 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Applicant's representative is thanked for returning the examiner's call on June 14, 2010, regarding the status inquiry sent on April 8, 2009. In this letter, the Serial Number and Inventor indicated were correct but the Title was not correct. The examiner was inquiring whether applicant meant to send out a status letter for this case as well as another case. Applicant's representative indicated that the status letter was for this application and the Title incorrect as an inadvertent error. The examiner informed applicant's representative that an office action on the merits was forthcoming.
2. The examiner acknowledges applicant's preliminary amendment of August 4, 2006, amending the claims as well as the specification and abstract.
3. The abstract of the disclosure is objected to because applicant has used what is considered to be "legal" phraseology in this instance, applicant has used phrase "The present invention", "The invention" and "according to the invention". Applicant should avoid using legal phraseology and terms like "the invention", "disclosed", "disclosure", "embodiment", "said" etc. Correction is required. See MPEP § 608.01(b).
4. Regarding claim 1, the phrase "in particular" renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d). Applicant is suggested to delete this phrase and either positively claim that the diluent gas is steam or should delete the entire phrase "in particular steam" and make a dependent claim from claim 1 which recites that the diluent gas is steam. Suitable correction is required.

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5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brown et al. US Patent 7,482,502 in combination with Bauer et al., US Patent 4,342,642.

Brown et al. teach the invention substantially as claimed. Brown et al. teach a cracking furnace for cracking a hydrocarbon feedstock into an olefinic product. Specifically the cracking furnace (2) includes a preheat convection section (4) and a radiant section (6). The radiant section (6) is provided with wall burners (8) and floor burners (10). The furnace can include combinations of wall burners and floor burners and are present in numbers sufficient to provide sufficient radiant heat for effecting the cracking reaction. The hot combusted gases produced by the burners exit the radiant section (6) of furnace (2) via transition flue (12) and proceed upwardly through the convection section (4) and exit the furnace via flue (14). The hydrocarbon feedstock

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enters the convection section (4) of the furnace through the feed line (16) and is preheated in a first exchanger (18) to a temperature from about 200°F to 1000°F. Dilution steam enters the convection section (4) through a separate feed line (22) and is heated in a second exchanger (17) to a temperature ranging from 700°F to 1200°F. The preheated feed and preheated dilution steam are then mixed together and reenter the convection section (4) into a third exchanger (10) in which the two admixed streams are heated to a temperature from 900°F to about 1450°F. The mixture in line 20 the "crossover" is then directed to the radiant section (6) of the furnace. The crossover (20) is made from conventional metallic materials. The types of metal used for the reactor or furnace cracking tubes (26) are made of high strength, oxidation resistant, corrosion resistant high temperature non-nickel containing material which include material such as silicon carbide materials, sintered silicon carbide or oxide dispersion strengthened material which includes rare earth oxide dispersion strengthened ferrous alloys or super alloys incoloy® MA956. [Note Column 6, lines 36 to Column 7, line 4, Column 7, lines 25-65]. Brown et al. further teach that the tubes (26) as shown in Figure 5A can include a plurality of fins (128) along the inner diameter or provided with a single bump "228". The fins (128) or bump (228) can be provided along any portion of the tube and can be provided on the inlet leg or the outlet leg or the "U" shaped portion. The fins and bumps can be used in combination if desired. Brown et al. teach that the purpose of the fins or bumps or combinations thereof is to improve heat transfer and allow the furnace tubes to operate at higher capacities within the constraints of the material from which the furnace tubes are constructed. [Note Column 8, lines 21-50] Brown et al further teach

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that the shape of the reactor furnace tube (26) is shown as a straight one-pass tube. However the reactor furnace tube may be of any configuration known such as offset, horizontal or serpentine or vertical parallel configuration. Brown further teaches that the inner diameter of the reactor furnace tube may be either constant or swaged.

However, Brown et al. do not specifically teach that the coil is more thermally shielded at the outlet section than the inlet section of the coil.

Bauer et al. teach a steam pyrolysis tubular coil and specifically at the outlet of the coil there is provided an interior insert to which provides a radiation absorption surface within the processing coil. The insert increases the heat flux without adversely increasing pressure drop. The insert is positioned at the outlet of the processing coil in the area where the most intense pyrolysis occurs. The tube insert is in the form of a central portion spaced from the inner tube wall having outwardly extending arms or vanes which touch or almost touch the inner wall of the tube; the insert subdivides the free internal cross-section of the tube into equal areas to provide for uniform gas flow. The insert has a length of at least 5 feet and occupies from 15% to 100% of the length of the last tube. By providing the insert, the heat flux is increased in the order of 10%-20% but not exceeding 50%.[Note Column 1, lines 20-65] Bauer specifically shows in Figure 2a, that the portion of the pyrolysis tube (31), particularly the outlet tube of each pass includes an interior insert to provide a radiation absorption surface within the outlet tube of the coil, the insert (100) is in the form of a three vaned spiral having a central body portion (111) and vanes (112) which are curved at the tips. Bauer et al. teach that the use of the insert increases heat flux through the tube wall by about 33.3% with a

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decrease in temperature of the inner tube wall, the insert produces only a slight increase in pressure drop. The improved heat flux permits reduction in residence time to increase selectivity and reduces coking tendency and reduces the inner wall tube temperature which will reduce thermal stress and fatigue of the tubes. [Note Column 3, lines 41-50 and Column 4, lines 41-53]

It would have been obvious from the combined teachings of Brown et al. and Bauer et al. to provide a method of cracking a hydrocarbon feed by passing the feed comprising a hydrocarbon a diluent gas such as steam through a cracking coil in a firebox under cracking conditions where in the coil includes an outlet section and inlet section wherein the outlet section of the coil is more thermally shield than in the inlet section of the coil because Brown et al. teach a process for cracking hydrocarbons using improved furnace reactor tubes. Brown et al. teach and review the prior art cracking furnaces and there a clear recognition in Brown et al. that cracking furnace efficiency is improved by using reactor tubes wherein the tube includes heat absorbing surfaces and that the cracking temperatures should be maintained at temperatures of about 1625oF. Brown et al. teach that the fire box are lined with refractory materials and are capable of delivering a greater heat load than the metallic tubes with the reactor furnaces can withstand. At high temperatures to which the reactor furnace tubes are exposed to in thermal cracking process, metallic materials have been the preferred material of construction for the coils and/or tubes. It is known by the thermal cracking furnace designers that high capacity and higher selectivity of the thermal cracking process requires improved properties of the metallic alloys used in the reactor.

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However, with high temperatures, conventionally known metallic tubes which are nickel alloys have a service temperature of around 2100oF and prolonged exposure to high temperatures will result in thermal fatigue of the metallic tubes. Brown et al. further teach that the nickel in the metallic tubes will also act as a catalyst and produce coke on the inside of the walls during cracking which will effect efficiency of the reactor and pressure drop and increase resistance to heat transfer between the outside of the reactor tube wall and bulk fluid flowing between reactor tube. Brown et al. teach with nickel being used to catalyze formation of coke, the art then has recognized that catalytic coking needs to be reduced and include means which include sulfur dosing and chemical treatments, cladding the metallic tubes or surface treating the metallic tubes, and/or adding dilution steam. Brown et al. recognize and teach that the reactor tubes should be made of a heat absorbing surface material and specifically the reactor furnace tubes are made of ceramic and/or oxide dispersion strengthened materials which do not contain nickel which obviates catalytic coke formation and also running the cracking reactor at higher temperatures and higher residence times the pyrolytic coke formation is also reduced. Brown et al. does teach and recognize using improved reactor tubes for used as a heat absorbing surface in the fire box of a furnace, the reaction tubes or coils are comprised of ceramic and/or oxide dispersion strengthened materials and permits higher reactor furnace tube temperatures than the prior art as well as improving product yields. Brown et al. teach and recognize that the coils can be arranged vertically and essentially parallel to each other, the coils or tubes can have a smooth surface or textured surface can include fins or bumps and the that the tubes can

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include thermal expansion and compensating means such as pigtails and offsets and the diameter of the tube or coil can be either constant or swaged. Brown as stated above does not teach applicant's specific recitation that the outlet section of the coil is more thermally shielded than at the inlet. The concept of thermally shielding the tubes at the outlet of the tube has been taught by Bauer et al. the reactor, reactor tubes/coils and application, i.e., steam pyrolysis or catalytic cracking to produce an olefinic product has been taught. To use the thermal shielding at the outlet of the tubes taught by Bauer for the same purpose as taught by Bauer in the reactor as described by Brown et al. renders applicant's invention as a whole obvious to the ordinary artisan, the concept of using a heat absorbing material and providing a heat absorbing surface is common to both Brown et al. and Bauer et al. thus making the substitution or inclusion of the thermal shielding at the outlet of the reactor tubes permissible and obvious to one familiar with hydrocarbon cracking and furnace design.

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Lenglet'226 teach a process and device for steam cracking a light and a heavy hydrocarbon feedstock. Johnson et al. teach a process and apparatus for the production of olefins from both heavy and light hydrocarbons. Hengstebeck teach a system for steam-cracking hydrocarbon and trans-line exchanger therefor. Platvoet et al. teach a pyrolysis heater for the cracking of hydrocarbons in the produce to olefins having specific burner arranged in the firebox. Michelson teach a radiation shield and method for shielding a furnace convection section. Tsai teach a hydrocarbon converter furnace having an upper convection zone and lower radiant heating zone and

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tubing which extends into both zones to convey a fluid hydrocarbon feed and steam in sequence through the convection and radiant heating zones. Woebcke'955 teach a furnace having horizontally disposed single pass tubes. Broodman teach a composite tube for heating gas. Woebcke'511 teach an apparatus for pyrolysis of hydrocarbons using an unfired super heater radiant section and a fired radiant section. Brewer et al.'027 teach a cracking furnace having radiant heating tubes the inlet and outlet legs of which are paired within the firebox. Martens et al. teach an apparatus for the steam cracking of hydrocarbons for the preparation of olefins and diolefins. Brewer et al.'041 teach a system and apparatus for stabilizing the movement of reactor furnace tubes of a fired heater. Bowen et al.'158 teach a thermal cracking furnace comprising horizontally disposed and vertically disposed radiant tube sections. DiNicolantonio et al.'055 teach a cracking furnace having bent/single pass tubes. Kreuter teach a cracking furnace with improved heat transfer to the fluid to be cracked. Narayanan teach an enhanced hydrocarbon pyrolysis reactor for the production of olefins. The radiant section tubes of the reactor are shaped to provide a continuously increasing volume per unit length from inlet to outlet of the reactor. Spoto et al. teach an enhanced radiant heat exchanger apparatus. Martens et al.'525 teach a cracking furnace in which between the inlet and outlet of the radiation zone, the diameter of the cracking tube increases and the thermal power of the burned used to heat the cracking tube decreases. Arisaki et al. teach a pyrolysis furnace for olefin production.

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9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to N. Bhat whose telephone number is 571-272-1397. The examiner can normally be reached on Monday-Friday, 9:30AM-6:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/N. Bhat/
Primary Examiner, Art Unit 1797